EPOS

Positioning Controller

Application Note
"Inputs and Outputs"

Edition August 2007

EPOS 24/1, EPOS 24/5, EPOS 70/10, MCD EPOS
Firmware version 2010h or higher

Introduction

The EPOS is a digital positioning system suitable for DC and EC (brushless) motors with incremental encoders in a modular package. The performance range of these compact positioning controllers ranges from a few watts up to 700 watts.

A variety of operating modes means that all kinds of drive and automation systems can be flexibly assembled using positioning, speed and current regulation. The in-built CANopen interface allows networking to multiple axis drives and online commanding by CAN bus master units.

Typical drive systems have the requirement of digital inputs and outputs. 'Home Switch', 'Positive- and Negative Limit Switches' and 'Brake Output' with enough current, these are only a few samples. Sometimes there is need of analogues inputs for process data like temperature, pressure or something else. All the configuration of the digital inputs and outputs are easy setup by a configuration wizard and may be changed online through the CANopen or serial bus.

Objectives

This application note explains the functionality of the inputs and the outputs.
Application examples are shown.

Required Tool

maxon motor EPOS Graphical User Interface GUI Version 1.10 or higher
Freely available at http://www.maxonmotor.com category «Service & Downloads», Order number 280937, 302267, 302287, 317270, 275512, 300583, 326343

References

maxon motor EPOS Firmware Specification
Freely available at http://www.maxonmotor.com category «Service & Downloads», Order number 280937, 302267, 302287, 317270, 275512, 300583, 326343

Digital Inputs

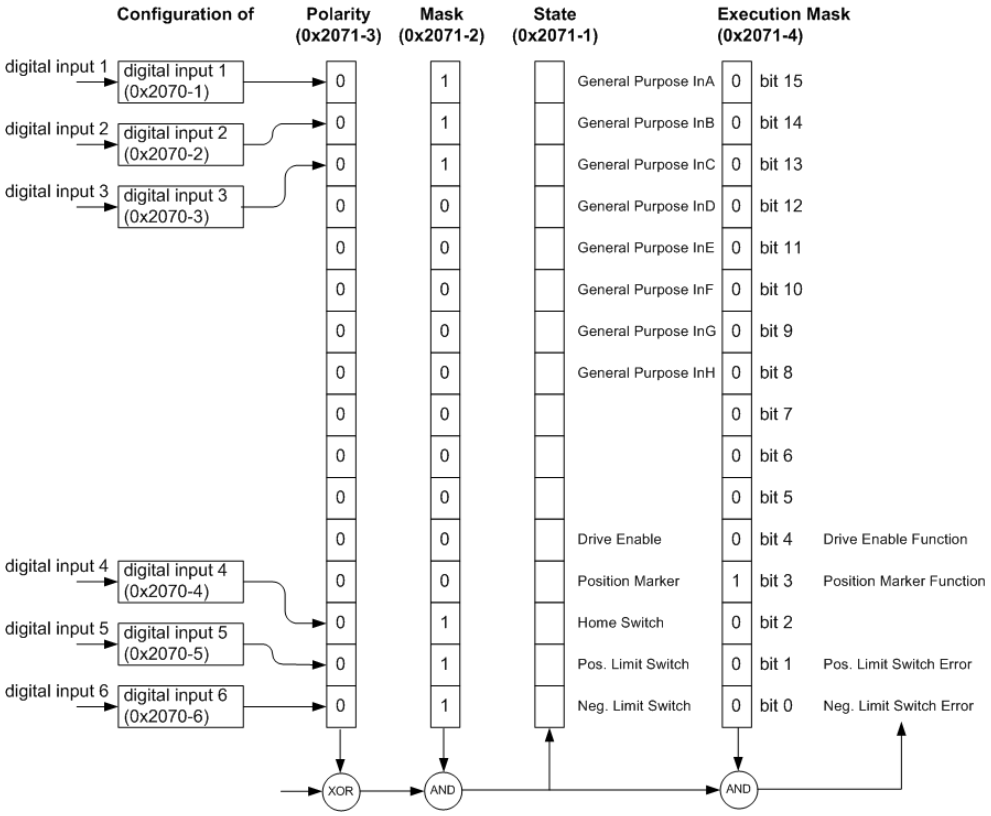


Figure 1: Digital Input Functionality EPOS 24/1 and EPOS 24/5 Overview (default configuration)

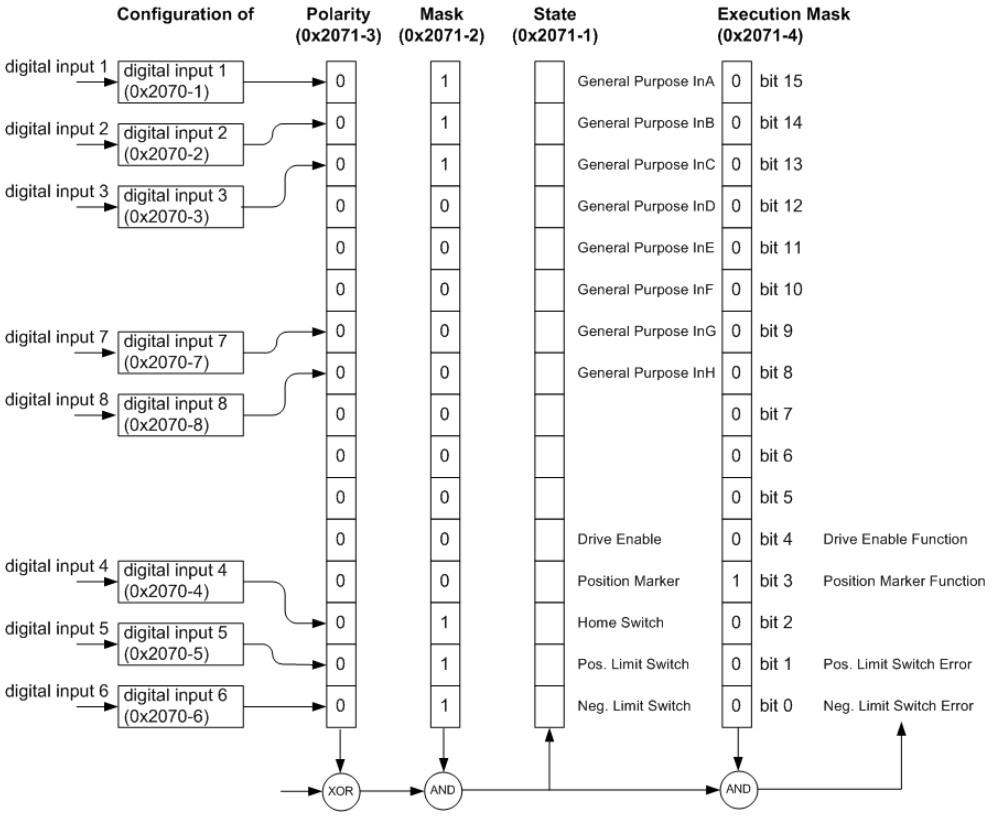


Figure 2: Digital Input Functionality EPOS 70/10 Overview (default configuration)

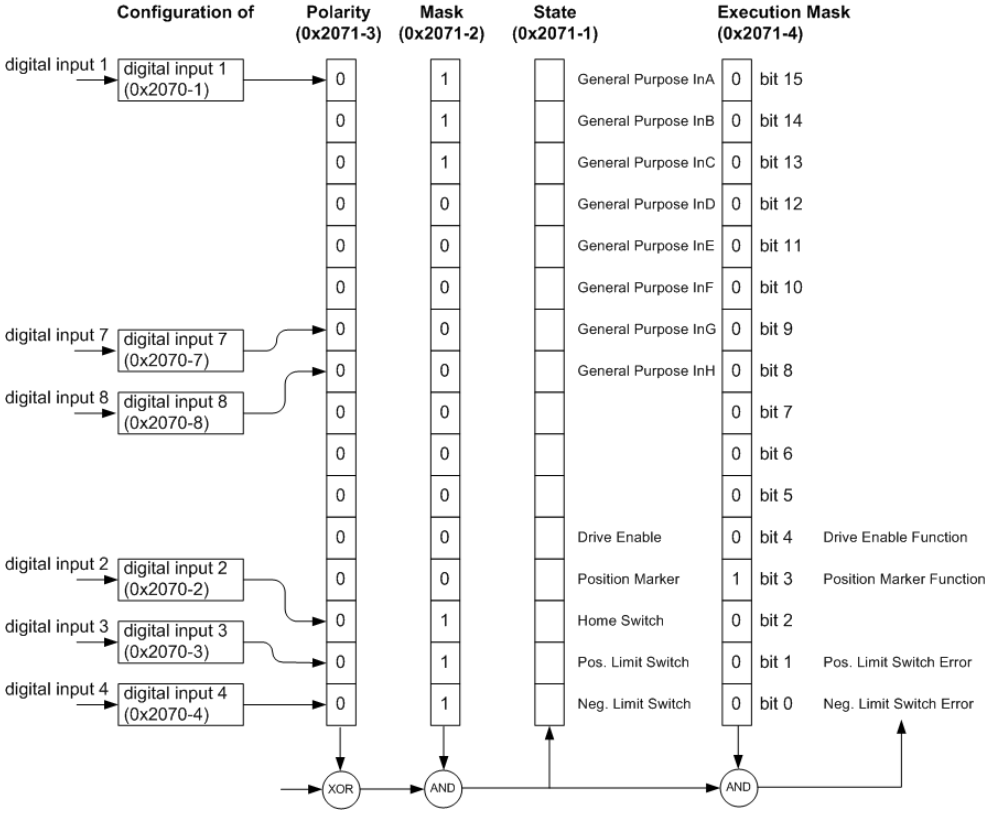


Figure 3: Digital Input Functionality MCD EPOS 60 W Overview (default configuration)

Configuration Parameter

Name	Index	Sub-Index	Description
Configuration of Digital Input 1[1]	0x2070	0x01	Configures which functionality will be assigned to digital input 1
Configuration of Digital Input 2[1]	0x2070	0x02	Configures which functionality will be assigned to digital input 2
Configuration of Digital Input 3[1]	0x2070	0x03	Configures which functionality will be assigned to digital input 3
Configuration of Digital Input 4[1]	0x2070	0x04	Configures which functionality will be assigned to digital input 4
Configuration of Digital Input 5[1]	0x2070	0x05	Configures which functionality will be assigned to digital input 5 *(not valid for MCD EPOS 60 W)*
Configuration of Digital Input 6[1]	0x2070	0x06	Configures which functionality will be assigned to digital input 6 *(not valid for MCD EPOS 60 W)*
Configuration of Digital Input 7[1]	0x2070	0x07	Configures which functionality will be assigned to digital input 7 *(EPOS 70/10 and MCD EPOS 60 W)*
Configuration of Digital Input 8[1]	0x2070	0x08	Configures which functionality will be assigned to digital input 8 *(EPOS 70/10 and MCD EPOS 60 W)*
Digital Input Functionalities Mask[2]	0x2071	0x02	Displayed state of digital input functionalities may be filtered
Digital Input Functionalities Polarity[3]	0x2071	0x03	Polarity of the digital input functionalities
Digital Input Functionalities Execution Mask[2]	0x2071	0x04	Digital input functionalities may be kept off from execution

Input Parameter

Name	Index	Sub-Index	Description
Digital Input Functionalities State[2]	0x2071	0x01	Display the state of the digital input functionalities.

[1] Input Configuration Values

The parameter "Configuration of Digital Input" defines the bit position in the "Digital Inputs Functionalities State".

Value	Functionality	Description
15	General Purpose A	State can be read
14	General Purpose B	State can be read
13	General Purpose C	State can be read
12	General Purpose D	State can be read
11	General Purpose E	State can be read
10	General Purpose F	State can be read
9	General Purpose G	State can be read
8	General Purpose H	State can be read
7 – 5	reserved	
4	Drive Enable	Enables / disables device
3	Position Marker	Samples actual position
2	Home Switch	Used in some homing modes
1	Positive Limit Switch	Generates Limit error / used in some homing modes
0	Negative Limit Switch	Generates Limit error / used in some homing modes

[2] Parameter Descriptions

bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
General Purpose A	General Purpose B	General Purpose C	General Purpose D	General Purpose E	General Purpose F	General Purpose G	General Purpose H
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
reserved	reserved	reserved	Device Enable	Position Marker	Home Switch	Positive Limit Switch	negative Limit Switch

[3] Polarity Values

The parameter "Digital Input Functionalities Polarity" defines the high- or low activity.

bit	0	1
associated pin	high active	low active

Note: - The "Digital Input Functionalities State" is only displayed, if the "Digital Input Functionalities Mask" is set to enable.
- The "Digital Input Functionalities Execution Mask" disables or enables the specific function.

Digital Outputs

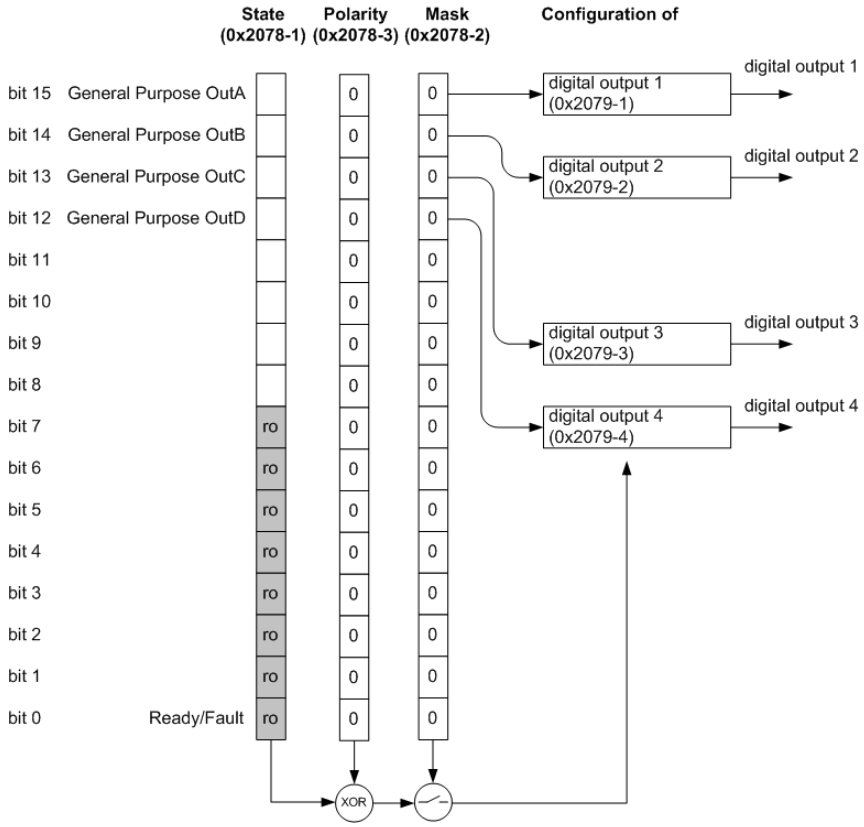


Figure 4: Digital Output Functionality EPOS 24/5 and EPOS 70/10 Overview (default configuration)

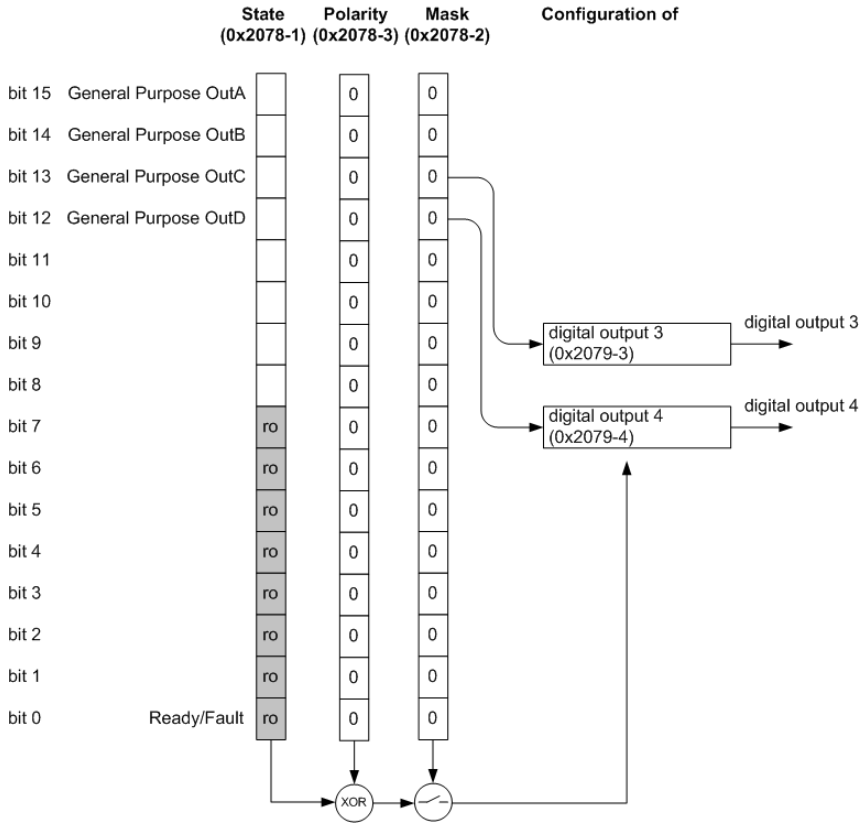


Figure 5: Digital Output Functionality EPOS 24/1 and MCD EPOS 60 W Overview (default configuration)

Configuration Parameter

Name	Index	Sub-Index	Description
Configuration of Digital Output 1[1]	0x2079	0x01	Configures which output functionality will be assigned to digital output 1
Configuration of Digital Output 2[1]	0x2079	0x02	Configures which output functionality will be assigned to digital output 2
Configuration of Digital Output 3[1]	0x2079	0x03	Configures which output functionality will be assigned to digital output 3
Configuration of Digital Output 4[1]	0x2079	0x04	Configures which output functionality will be assigned to digital output 4
Digital Output Functionalities Mask[2]	0x2078	0x02	With this object the digital outputs may be filtered
Digital Output Functionalities Polarity[3]	0x2078	0x03	Polarity change of digital output

Note: Digital outputs 1 and 2 are not connected on the EPOS 24/1 and MCD EPOS 60 W.

Output Parameter

Name	Index	Sub-Index	Description
Digital Output Functionalities State[2]	0x2078	0x01	With this object the digital outputs can be set.

[1] Output Configuration Values

The parameter "Configuration of Digital Output" defines the bit position in the "digital output functionalities state".

Value	Functionality	Description
15	General Purpose OutA	Can be written by user
14	General Purpose OutB	Can be written by user
13	General Purpose OutC	Can be written by user
12	General Purpose OutD	Can be written by user
11 – 8	not used	
7 – 1	reserved	
0	Ready / Fault	Active on Device Ready / Inactive on Fault

[2] Parameter Descriptions

bit15	bit14	bit13	bit12	bits11 … 1	bit0
General Purpose OutA	General Purpose OutB	General Purpose OutC	General Purpose OutD	reserved	Ready / Fault

[3] Polarity Values

The polarity is may be changed with the parameter "Digital Output Functionalities Polarity".

bit	0	1
associated pin	not inverted 1 -> high 0 -> low	inverted 0 -> high 1 -> low

Note: A change in "Digital Output Functionalities State" can only have effect, if "Digital Output Functionalities Mask" is enabled.

Standard Signal Cable

Order number: EPOS signal cable **275932**

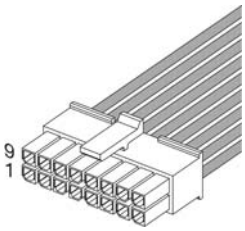


Figure 6: Pin assignment signal cable 1 head A

Pin No.	Colour	Description EPOS 24/1 (#302287)	Description EPOS 24/5 (#275512)	Description EPOS 70/10 (#300583)
1	White	Digital signal ground	Digital signal ground	Common signal 2 for Digital input4…6
2	Brown	Digital signal ground	Digital signal ground	Common signal 1 for Digital input1…3
3	Green	Digital input 6 “Negative Limit Switch”	Digital input 6 “Negative Limit Switch”	Digital input 6 “Negative Limit Switch”
4	Yellow	Digital input 5 “positive Limit Switch”	Digital input 5 “positive Limit Switch”	Digital input 5 “Positive Limit Switch”
5	Grey	Digital input 4 “Home Switch”	Digital input 4 “Home Switch”	Digital input 4 “Home Switch”
6	Pink	Digital input 3 “General Purpose”	Digital input 3 “General Purpose”	Digital input 3 “General Purpose”
7	Blue	Digital input 2 “General Purpose”	Digital input 2 “General Purpose”	Digital input 2 “General Purpose”
8	Red	Digital input 1 “General Purpose”	Digital input 1 “General Purpose”	Digital input 1 “General Purpose”
9	Black	**Auxiliary supply voltage Output (+5 VDC / 10mA)**		**Ext. supply input voltage for Digital Outputs (+12... 24 VDC)**
9[1]	Black		**Auxiliary supply voltage Output (+11 … +24 VDC)**	
9[2]	Black		**Logic supply voltage Input (+11 … +24 VDC)**	
10	Violet	Digital output 4 “General Purpose”	Digital output 4 “Brake”	Digital output 4 “Brake”
11	Grey-Pink	Digital output 3 “General Purpose”	Digital output 3 “General Purpose”	Digital output 3 “General Purpose”
12	Red-Blue	**Power supply voltage +9…+24 VDC**	Digital output 2 “General Purpose”	Digital output 2 “General Purpose”
13	White-Green	**Power Ground**	Digital output 1 “General Purpose”	Digital output 1 “General Purpose”
14	Brown-Green	Analogue signal ground	Analogue signal ground	Digital OUT Ground refer to ”+V Opto IN”
15	White-Yellow	Analogue input 2	Analogue input 2	Not connected
16	Yellow-Brown	Analogue input 1	Analogue input 1	Not connected

Connector: Molex Micro-Fit 3.0™ 16 poles (430-25-1600)
Crimp terminals: Molex Micro-Fit 3.0™ female crimp terminals (430-30-0010)
Hand crimper: Molex hand crimper (Europe: 69008-0983; America: 63811-2800)

[1] Jumper JP4 is set (initial setting).
[2] If jumper JP4 is open, a separate logic supply voltage can be applied.

Extended Signal Cable (Connector J5A)

Order number: EPOS signal cable **300586**

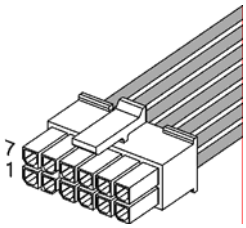


Figure 7: Pin assignment signal cable 2 head A

Pin No.	Colour	Twisted wire	Description EPOS 70/10 (#300583)
1	White	Pair 1	Reference Output voltage +5V
2	Brown	Pair 1	Analogue signal ground
3	Green	Pair 2	Negative analogue signal input 2
4	Yellow	Pair 2	Positive analogue signal input 2
5	Grey	Pair 3	Negative analogue signal input 1
6	Pink	Pair 3	Positive analogue signal input 1
7	Blue	Pair 4	Digital signal ground
8	Red	Pair 4	Digital signal ground
9	Black	Pair 5	Digital input 8 “high speed command” complement signal
10	Violet	Pair 5	Digital input 8 “high speed command”
11	Grey-Pink	Pair 6	Digital input 7 “high speed command” complement signal
12	Red-Blue	Pair 6	Digital input 7 “high speed command”

Connector: Molex Micro-Fit 3.0TM 12 poles (430-25-1200)
Crimp terminals: Molex Micro-Fit 3.0TM female crimp terminals (430-30-0010)
Hand crimper: Molex hand crimper (Europe: 69008-0983; America: 63811-2800)

MCD EPOS Signal connector

Order number: MCD EPOS signal cable **326923**

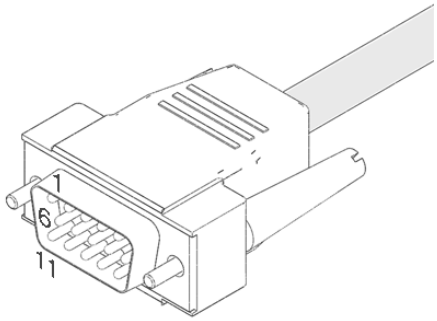


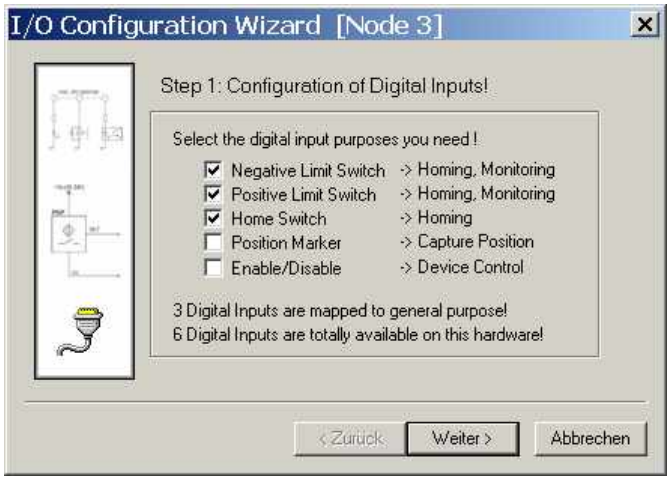
Figure 8: Pin assignment MCD EPOS Signal Cable head A

Connect this cable end to MCD EPOS connector J2 “Power / Communication connector “.

Pin No.	Colour	Description
1	White	Digital input 7 “High Speed Command” signal
2	Brown	Digital input 7 “High Speed Command” complement signal
3	Green	Digital input 8 “High Speed Command” signal
4	Yellow	Digital input 8 “High Speed Command” complement signal
5	Grey	Digital signal ground
6	Pink	Digital input 1 “General Purpose”
7	Blue	Digital input 2 “Home Switch”
8	Red	Digital input 3 “Positive Limit Switch”
9	Black	Digital input 4 “Negative Limit Switch”
10	Violet	Common signal for Digital input 1…4
11	Grey-Pink	External supply Input voltage for Digital Outputs (+12 … 24VDC)
12	Red-Blue	Digital output 3 “General Purpose”
13	White-Green	Digital output 4 “General Purpose”
14	not connected	
15	not connected	

Connector: Male D-Sub connector high-density, 15 poles with mounting screws

Configuration

Step 1: Open I/O Configuration Wizard	After the standard system configuration using the EPOS Graphical User Interface GUI and the Startup Wizard start the I/O Configuration Wizard. 
Step 2: Digital Inputs	If there are digital inputs in your system you may select a pre-defined functionality.  - Negative Limit Switch - Positive Limit Switch - Home Switch - Position Marker (the captured position is hold in object: Position Marker Captured Position 0x2074-01) - Enable / Disable (enable and disable device by hardware input)

Step 3:
Predefined Functionalities

Select the right configuration for each functionality.

Negative Limit Switch

Digital Input	Select the input, where the "Negative Limit Switch" is wired
Switch Output	NPN switch or PNP switch
Switch Output State	Normally open or normally closed
Limit Switch Monitoring	Disable or enable

Positive Limit Switch

Digital Input	Select the input, where the "Positive Limit Switch" is wired
Switch Output	NPN switch or PNP switch
Switch Output State	Normally open or normally closed
Limit Switch Monitoring	Disable or enable

Home Switch

Digital Input	Select the input, where the "Home Switch" is wired
Switch Output	NPN switch or PNP switch
Switch Output State	Normally open or normally closed

Position Marker

Digital Input	Select the input, where the “Position Marker" is wired
Polarity	High- or low active
Capture Trigger	Both edges, rising edge or falling edge

Enable / Disable

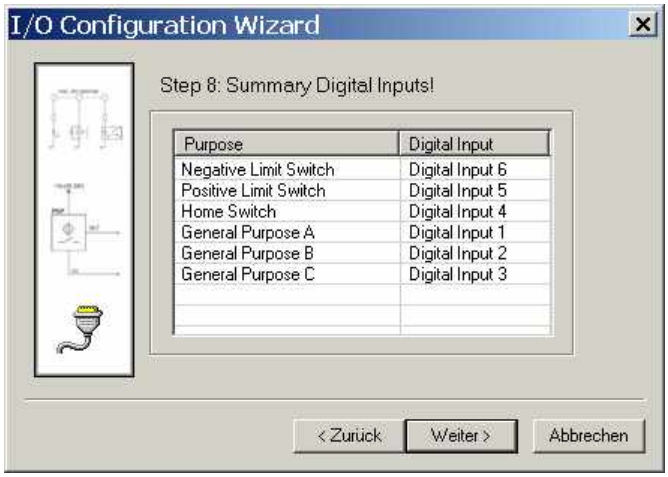
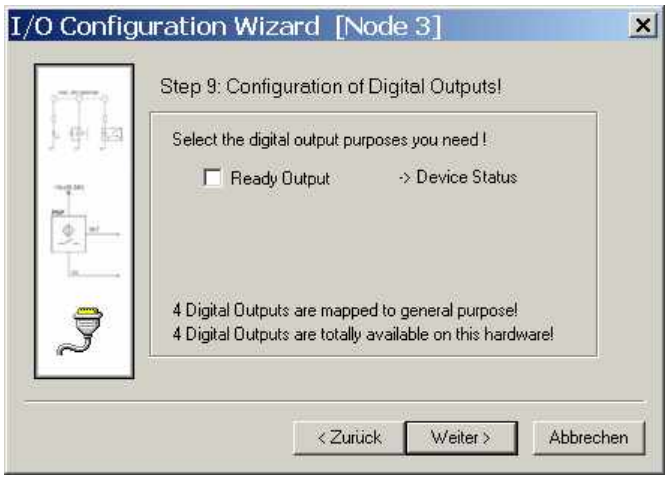
Digital Input	Select the input, where the "Enable / Disable" input is wired
Polarity	High- or low active

Step 4:
General Purpose

The remaining inputs may be use for general purpose

General Purpose

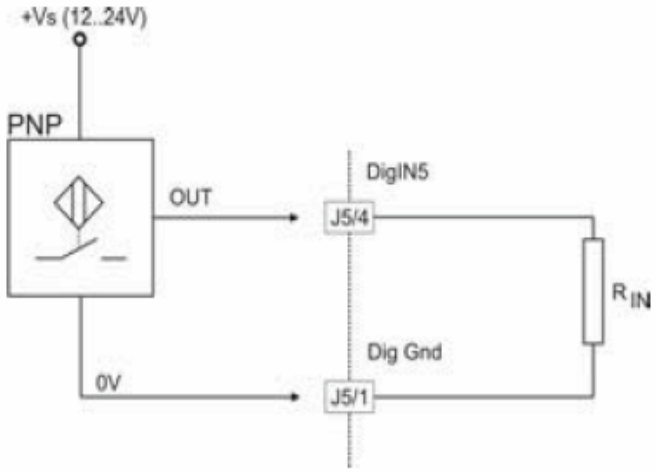
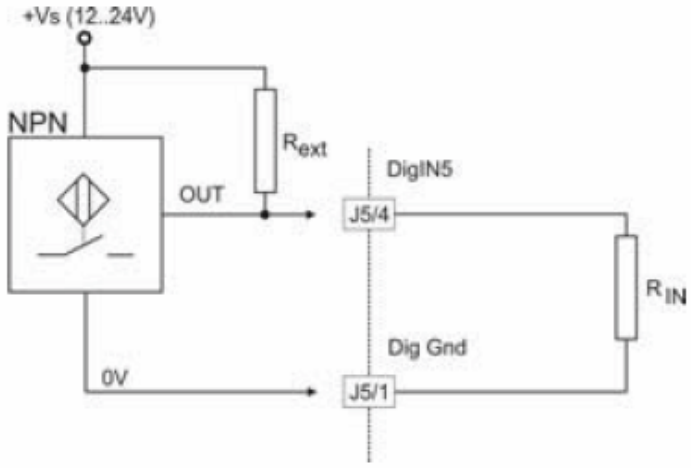
Digital Input	Select the input, where the general purpose input is wired
Polarity	High- or low active

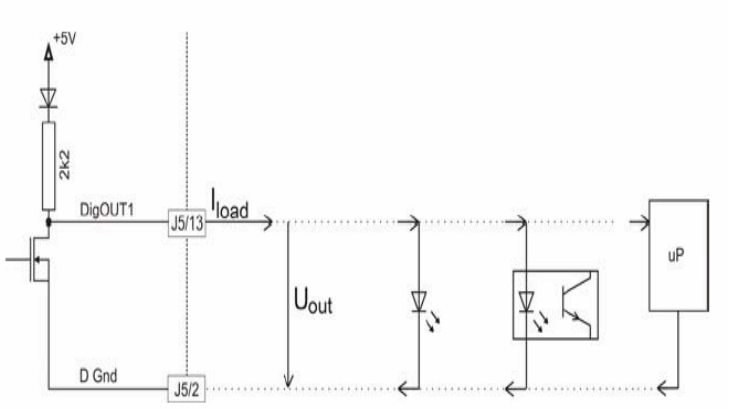
<table>
<tr><td>Step 5:
Correctness Check</td><td>Check all settings.
 
</td></tr>
<tr><td>Step 6:
Output Configuration</td><td>If their system needs digital outputs for "Ready Information" you may select a pre-defined functionality.
 
</td></tr>
<tr><td>Step 7:
Predefined Functionalities</td><td>Select the right configuration for each functionality.

Ready Output
<table>
<tr><td>Digital Output</td><td>Select the output, where the "Ready Signal" is wired</td></tr>
<tr><td>Polarity</td><td>High- or low active</td></tr>
</table></td></tr>
<tr><td>Step 8:
General Purpose</td><td>The remaining outputs may be use for general purpose.

General Purpose A
<table>
<tr><td>Digital Output</td><td>Select the output, where the "General Purpose" is wired</td></tr>
<tr><td>Polarity</td><td>Low- or high active</td></tr>
<tr><td colspan="2">General Purpose B</td></tr>
<tr><td>Digital Output</td><td>Select the output, where the "General Purpose" is wired</td></tr>
<tr><td>Polarity</td><td>Low- or high active</td></tr>
<tr><td colspan="2">General Purpose C</td></tr>
<tr><td>Digital Output</td><td>Select the output, where the "General Purpose" is wired</td></tr>
<tr><td>Polarity</td><td>Low- or high active</td></tr>
</table></td></tr>
<tr><td>Step 9:
I/O Monitor</td><td>With the I/O Monitor it is possible to watch all the states of the digital and analogue inputs and it is also possible to set the digital outputs.</td></tr>
</table>

Wiring Examples

Example 1: EPOS 24/5 and PNP Switches	Normally closed (default configuration of EPOS) and normally open (configuration must be changed) switch outputs are suitable. 
Example 2: EPOS 24/5 and NPN Switches	With external pull up resistor (R_{ext}) it is also possible to connect NPN switches. Normally open (default configuration of EPOS) and normally closed (configuration must be changed) switch outputs are suitable.  R_{ext} (12V) = 510 Ω R_{ext} (24V) = 4300 Ω

Example 3: EPOS 24/5 and LED	It is possible to drive loads with very small current requirements like LED's or microprocessor inputs. 
Example 4: EPOS 24/5 and Brake	It is possible to drive loads with very high current requirements like motor brakes and warning lights directly with the EPOS 24/5 Output 4.